

CLAIMS

What is claimed is:

- 1 1. A method of automatically configuring a network device, the method comprising the
2 computer-implemented steps of:
3 receiving a request from the network device to provide configuration information;
4 retrieving a template describing a device configuration, wherein the template
5 comprises zero or more parameters that may receive values specific to a
6 particular device;
7 retrieving zero or more values of parameters specific to the device;
8 creating and storing a device-specific instance of the configuration information based
9 on the template and the values of parameters and conforming to an Extensible
10 Markup Language Document Type Definition (XML DTD), comprising one
11 or more XML tags that delimit the configuration information.
- 1 2. A method as recited in Claim 1, further comprising the steps of:
2 testing the configuration information to determine whether it is well-formed with
3 respect to the XML DTD;
4
5 providing the configuration information to the network device.
- 1 3. A method as recited in Claim 1, further comprising the steps of:
2 testing the configuration information to determine whether it is well-formed with
3 respect to the XML DTD;
4
5 providing the configuration information to the network device over a reliable
6 transport protocol that assures that the entire configuration information is
7 received at the network device.

1 5. A method as recited in Claim 1, further comprising the steps of:
2 at the network device,
3 syntax checking the configuration information to determine whether
4 configuration commands therein conform to a command language that is
5 understood by the network device;
6 applying the configuration information to the network device;
7 when a syntax error is detected during the syntax checking step, publishing an
8 event that reports the syntax error using an event service.

6. A method as recited in Claim 1, further comprising the steps of:
providing the configuration information to a plurality of network devices;
at one of the network devices, syntax checking the configuration information to
determine whether configuration commands therein conform to a command
language that is understood by the network device;
upon successful syntax checking, generating an event to an event service to which the
plurality of network devices subscribe, wherein the event announces that the
configuration commands conform to correct syntax;
in response to receiving the event, applying the configuration information to the
network devices concurrently.

1 7. A method as recited in Claim 1, further comprising the steps of:
2 providing the configuration information to a plurality of network devices;

1 12. A method as recited in Claim 1, wherein the step of receiving a template comprises
 2 the step of retrieving a template describing the configuration information, wherein the
 3 template comprises zero or more parameters that may receive values specific to a
 4 particular device, and wherein the step of receiving zero or more values of parameters
 5 specific to the device comprises the step of retrieving a container object associated
 6 with the network device from the directory and obtaining the values of parameters
 7 from directory objects contained within the container object.

1 13. A method as recited in Claim 1, wherein the step of receiving a template comprises
 2 the steps of:
 3 retrieving a reference to a template describing the configuration information from a
 4 directory service;
 5 retrieving the template from a configuration server based on the received reference,
 6 wherein the template comprises zero or more parameters that may receive
 7 values specific to a particular device, and wherein the step of receiving zero or
 8 more values of parameters specific to the device comprises the step of
 9 retrieving a container object associated with the network device from the
 10 directory and obtaining the values of parameters from directory objects
 11 contained within the container object.

1 14. A method as recited in Claim 5, wherein the step of syntax checking comprises
 2 parsing one or more configuration commands within the configuration information
 3 using a parser of an operating system that is executed by the network device.

1 15. The method as recited in Claim 1, further comprising the steps of:
 2 determining that a partial configuration should be sent to one or more network
 3 devices;

4 based on the template and the zero or more values of parameters specific to the
 5 device, creating and storing a device-specific instance of the partial
 6 configuration based on the template and the values of parameters and
 7 conforming to an Extensible Markup Language Document Type Definition
 8 (XML DTD), comprising one or more XML tags that delimit the partial
 9 configuration;
 10 publishing the partial configuration to an event service that is communicatively
 11 coupled to the network devices.

1 16. The method as recited in Claim 1, further comprising the steps of:
 2 determining that a partial configuration should be sent to one or more network
 3 devices;
 4 based on the template and the zero or more values of parameters specific to the
 5 device, creating and storing a device-specific instance of the partial
 6 configuration based on the template and the values of parameters and
 7 conforming to an Extensible Markup Language Document Type Definition
 8 (XML DTD), comprising one or more XML tags that delimit the partial
 9 configuration;
 10 publishing a partial configuration trigger event to an event service that is
 11 communicatively coupled to the network devices; providing the partial
 12 configuration to one or more network devices in response to requests
 13 therefrom that are received in response to the trigger event.

1 17. A method of automatically configuring a network device, the method comprising the
 2 computer-implemented steps of:
 3 generating a request to provide configuration information;

4 receiving a set of configuration information conforming to an Extensible Markup
5 Language Document Type Definition (XML DTD), the configuration
6 information comprising one or more XML tags that delimit the configuration
7 information, based on a template describing a device configuration that is
8 instantiated with zero or more parameter values that are specific to the
9 network device;
10 syntax checking the configuration information to determine whether configuration
11 commands therein conform to a command language that is understood by the
12 network device;
13 applying the configuration information to the network device.

1 18. A method as recited in Claim 17, wherein the set of configuration information is
2 received concurrently at a plurality of network devices, and further comprising the
3 steps of:
4 at one of the network devices, syntax checking the configuration information to
5 determine whether configuration commands therein conform to a command
6 language that is understood by the network device;
7 upon successful syntax checking, generating a status event to an event service to
8 which the plurality of network devices subscribe, wherein the status event
9 announces that the configuration commands conform to correct syntax;
10 in response to receiving a “write” event, applying the configuration information to the
11 network device.

1 19. A method as recited in Claim 17, wherein the step of generating a request to provide
2 configuration information comprises the step of generating an HTTP request that
3 identifies a configuration service that can provide the configuration information and
4 that includes a unique identifier of the network device.

1 21. A method as recited in Claim 17, wherein the step of generating a request to provide
2 configuration information comprises the step of generating an HTTP request that
3 identifies a Java® Servlet of a configuration service that can provide the configuration
4 information and that includes a unique identifier of the network device.

22. A method as recited in Claim 17, wherein the step of receiving a set of configuration information comprises the steps of, at a configuration server, receiving a template describing the device configuration from a directory service, wherein the template comprises zero or more parameters that may receive values specific to a particular device, and wherein the step of receiving zero or more values of parameters specific to the device comprises the step of retrieving a container object associated with the network device from the directory and obtaining the values of parameters from directory objects contained within the container object.

23. A method as recited in Claim 17, wherein the step of syntax checking comprises applying the configuration commands to a parser of an operating system that is executed by the network device.

1 24. An apparatus for automatically configuring a network device, comprising:
2 a configuration service configured for carrying out the steps of:
3 receiving, from a configuration agent executed by the network device, a
4 request to provide configuration information;

9 creating and storing a device-specific instance of the configuration information based
 10 on the template and the values of parameters and conforming to an Extensible
 11 Markup Language Document Type Definition (XML DTD), comprising one
 12 or more XML tags that delimit the configuration information.

1 27. An apparatus for automatically configuring a network device, comprising:
 2 means for receiving a request from the network device to provide configuration
 3 information;
 4 means for retrieving a template describing a device configuration, wherein the
 5 template comprises zero or more parameters that may be resolved into values
 6 specific to a particular device;
 7 means for retrieving zero or more values of parameters specific to the device;
 8 means for creating and storing a device-specific instance of the configuration
 9 information based on the template and the values of parameters and
 10 conforming to an Extensible Markup Language Document Type Definition
 11 (XML DTD), comprising one or more XML tags that delimit the configuration
 12 information.

1 28. An apparatus for automatically configuring a network device, comprising:
 2 a network interface that is coupled to the data network for receiving one or more
 3 packet flows therefrom;
 4 a processor;
 5 one or more stored sequences of instructions which, when executed by the processor,
 6 cause the processor to carry out the steps of:
 7 generating a request to provide configuration information;
 8 retrieving a set of configuration information conforming to an Extensible Markup
 9 Language Document Type Definition (XML DTD), the configuration
 10 information comprising one or more XML tags that delimit the configuration
 11 information, based on a template describing a device configuration that is
 12 instantiated with zero or more parameter values that are specific to the
 13 network device;

6 one or more container objects stored in the directory service and associated with the
7 network device, each of the container objects comprising values for the zero or
8 more parameters in one of the configuration templates that corresponds to the
9 network device.

1 32. A method of automatically configuring a computer program application that uses
2 information about network devices or topology in order to operate in a network
3 environment, comprising the steps of:
4 receiving a request for network topology information from the application;
5 retrieving a template of network topology information from a repository;
6 resolving elements of the topology into application-specific values, resulting in
7 creating and storing resolved topology information;
8 providing the resolved configuration information to a configuration agent within the
9 application that is configured to re-configure the application to operate with
10 the then-current network configuration.

1 33. A method as recited in Claim 32, wherein resolving elements of the topology includes
2 the step of carrying out application-specific syntax checking of elements of the
3 template.